Instructions

for the use of

Weston Model 310 Portable Wattmeters

1919

Weston Electrical Instrument Co.
Newark, N. J.

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THE Weston Model 310 Wattmeter is an electrodynamometer wattmeter; its indications are based on the international volt and ampere, and are equally accurate for direct current and alternating current measurements, within the limits stated on the certificate accompanying the instrument.

SHIELDING The instrument is shielded from the effect of external magnetic fields by means of a double iron shield.

When using the instrument on direct current, if it is desired to obtain the greatest accuracy, the mean of reversed readings should be taken to eliminate the effect of any slight residual magnetism in the shield, which may have been produced by exposure to strong magnetic fields.

To obtain reversed readings the connections to both the current and potential circuits must be reversed.

ZERO ADJUSTER If the pointer is not exactly on zero when the instrument is not connected to the circuit, the fault can be corrected by means of the zero adjuster which is located at the center of the name-plate.

RANGES In general the instrument has two current and two potential ranges which are self-contained. The current ranges are changed by means of links which connect the two sections of the field coils in series or in multiple. (See certificate.) The potential ranges are changed by making the connections to individual binding posts.

EXTENSION OF RANGES If the instrument has a current range of 5 amperes, it can be used with current transformers to extend the range.

If the instrument has a 150-volt range the potential range can be extended by using potential transformers. For voltages less than 750 volts a multiplier may be used, but for higher voltages it is best to use a transformer; it is safer, in that only low voltage is applied to the instrument.

THE SCALE The scale is drawn and figured so as to permit readings being taken with the greatest facility and accuracy. To accomplish this each scale division represents units of 1, 2 and 5 or decimal multiples of them.

In every case the factor by which the scale reading must be multiplied in order to ascertain the watts indicated is given on the certificate. Each range of the instrument is provided for in this manner.

Model 310 Wattmeter, Form 1

GENERAL ARRANGEMENT Figure 1 shows the general arrangement of the binding posts, reversing switch, contact key, etc., and in Figure 2 the relation of the internal connections to the binding posts, etc., is shown.

POLARITY The sign ± used in reference to the binding posts of the current and potential circuits signifies that the instantaneous currents entering into or passing out from these binding posts, have the same direction.

CONTACT KEY The potential circuit is provided with a contact key which in its normal position opens the circuit. Readings are taken by depressing the key. If desired, the key may be locked by giving it a slight turn when depressed.

REVERSING SWITCH The reversing switch is in the potential circuit, and is used for changing the polarity of this circuit. Whenever the pointer of the instrument deflects below zero, it can be made to deflect up the scale without changing the connections to the instrument by turning the reversing switch. This will be found particularly advantageous when using the instrument to measure the power in polyphase circuits using a single wattmeter. (See Figures 14 and 15 and note under Figures 14 and 15, pages 28 and 29.)

When the reversing switch is at the position marked "Direct" the polarity of the potential circuit is as marked on the instrument.

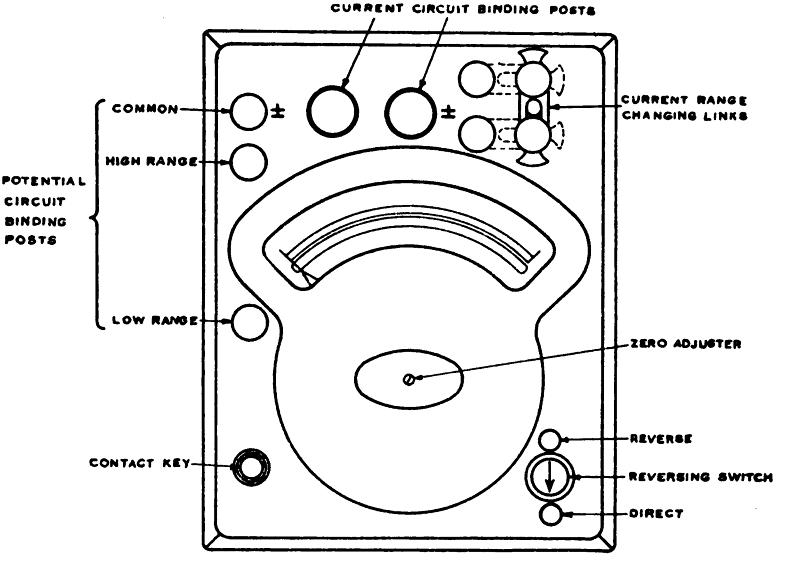

Figure 1

Arrangement of Binding Posts, Range Changing Links, Etc., on the Model 310 Wattmeter, Forms 1 and 3.

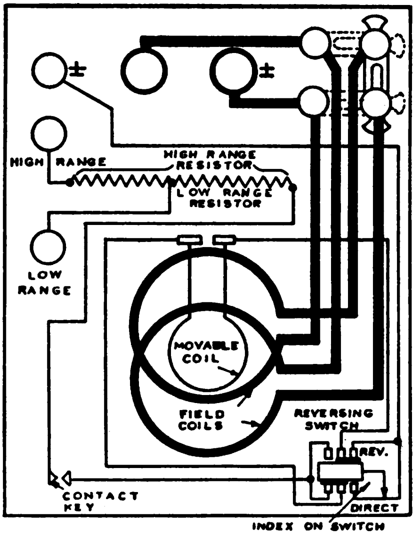

Figure 2

Internal Connections of Model 310 Wattmeter, Forms 1 and 3.

Note: Figures 1 and 2. When the links are in the position indicated by full lines the sections of the field are connected in series and the instrument is ready for use on the low current range. When the links are in the position indicated by dotted lines the sections of the field are connected in multiple and the instrument is ready for use on the high current range.

The links should be tightly screwed in position, otherwise one section of the current circuit may carry more current than the other section and become heated when using the instrument at its full rated current capacity.

<u>OVERLOAD CAPACITY</u> The field coils have an overload capacity of 100 per cent, that is, they are capable of continuously carrying twice the normal

rated current. This is of great advantage when making measurements on circuits of low power factor.

In various ranges of the instrument the potential circuits have an average overload capacity of 50 per cent. The actual overload capacity is stated on the certificate which accompanies the instrument. This overload capacity is convenient when it is desired to get an increased deflection (within the overload limits) and the current circuit can not be arranged to accomplish this.

Both of these conditions are made clear in the actual examples given later (see page 16).

TEMPERATURE CORRECTIONS The instrument is in general compensated for temperature errors. If in a special instance this is not so, the factor by which the indicated watts must be multiplied to get the actual watts, is given on the certificate.

PHASE ANGLE The phase displacement or shift which is usually known as the phase angle of the wattmeter is the difference between the true phase angle in the circuit under test and the apparent phase angle which enters into the wattmeter measurement. This phase shift or angle is produced in general in two ways: (1) The potential circuit has a small inductance which causes the current through it to lag behind the impressed voltage by a small angle. (2) Foucault or eddy currents are generated in the metal of the field coils and in the surrounding metal parts resulting in the magnetic field not being exactly in phase with the field coil current producing it, but lagging behind the field coil current by a small angle.

In the Model 310 Wattmeter, Form 1, the phase angle has been reduced to a negligible value for frequencies as high as 133 cycles per second. This has been accomplished by making

the time constant of the potential circuit so small as to be negligible and by practically eliminating the effect of Foucault currents on the indication of the wattmeter, attained by making the metal parts surrounding the coils of a special high resistance alloy and by a proper design as to the form and location of these parts.

The importance of having the wattmeter phase angle small can be appreciated by reference to the following illustration. Suppose we have a wattmeter the phase angle of which is 10 minutes. At 95 per cent power factor the error will be less than 0.1 of 1 per cent, but at 20 per cent power factor the error will be approximately 1.4 per cent.

FREQUENCY ERRORS As stated under "Phase Angle," the indications of the instrument are independent of frequency within the limits stated on the certificate, which for Form 1 instruments, is 133 cycles per second.

The instruments are accurate on much higher frequencies when the wave form is sinusoidal, but this conservative frequency is stated in order that the errors may be negligible when measurements are made in which the current contains harmonics of large amplitude.

CONSTANTS OF THE INSTRUMENT The resistance and inductance of the current and potential circuits for the various ranges are given on the certificate. These values will be found of use when allowing for instrument losses as hereinafter described, and for correcting for transformer errors when the instruments are used in conjunction with transformers.

For methods of corrections and uses of the instrument, see pages 15 to 23.

Low Power Factor Model 310 Wattmeter, Form 2

GENERAL ARRANGEMENT Figure 3 shows the general arrangement of the binding posts, compensating switch, reversing switch, etc. Figure 4 shows the relation between the internal connections and binding posts, etc.

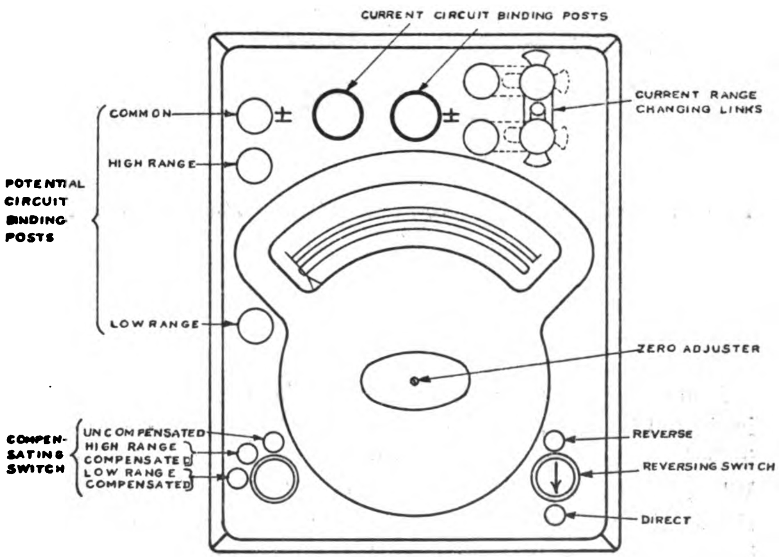

Figure 3

Arrangement of Binding Posts, Range Changing Links, Etc., on the "Low Power Factor" Model 310 Wattmeter, Form 2.

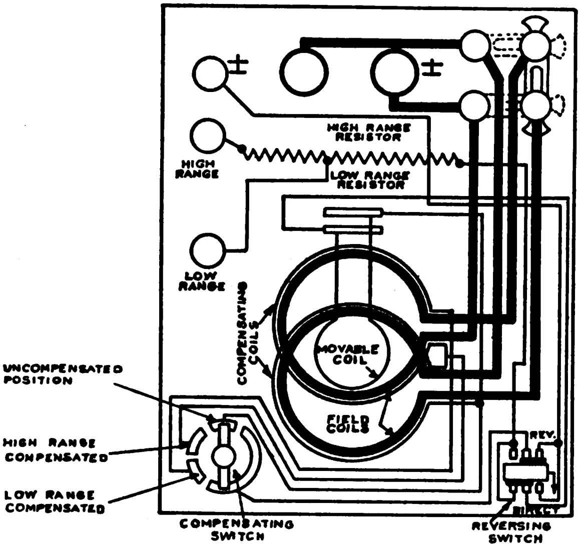

Figure 4

Internal Connections of the "Low Power Factor" Model 310 Wattmeter, Form 2.

Note: Figures 3 and 4. When the links are in the position indicated by full lines the sections of the field are connected in series and the instrument is ready for use on the low range. When the links are in the position indicated by dotted lines the sections of the field are connected in multiple and the instrument is ready for use on the high current range.

The links should be tightly screwed in position, otherwise one section of the current circuit may carry more current than the other section and become heated when using the instrument at its full rated current capacity.

COMPENSATION When a wattmeter is connected to measure the power in a circuit, the current through the field coils is the sum of the load current and the current required by the potential circuit of the wattmeter. This introduces an error in the indication of the instrument.

In order to eliminate this error in the "Low Power Factor" Model 310 Wattmeter, Form 2, the instrument is compensated for the power taken by the potential circuit. The compensation is effected by means of a winding connected in the potential circuit having the same effective number of turns as the field winding, and wound in such a direction that the current in it is opposite to that in the field winding. The current in this winding then exactly neutralizes that part of the current in the field winding which supplies the potential circuit.

COMPENSATING SWITCH The compensating switch (Figure 3, page 11) is capable of being set at three different positions. (1) The position for using the instrument uncompensated, in which condition its connections are the same as for the Model 310 Wattmeter, Form 1; (2) the position for using the instrument compensated for the high current range, and (3) the position for using the instrument compensated for the low current range.

CURRENT AND VOLTAGE CAPACITY The maximum capacity of the various current and potential ranges is given on the certificate. These values should not be exceeded.

The maximum capacity in volt-amperes is five times the maximum scale reading in watts.

TEMPERATURE CORRECTIONS For ordinary measurements it is not necessary to correct for changes in temperature. When very precise measurements

are desired the reading should be corrected by applying the proper correction which is given on the certificate.

PHASE ANGLE The phase angle of the instrument is so exceedingly small that the resulting errors are entirely negligible for frequencies to 133 cycles per second. (See under Model 310 Wattmeter, Form 1, page 9.

FREQUENCY ERRORS The instrument is practically free from errors due to changes in frequency and can be used on frequencies as high as 133 cycles per second without introducing any readable error, in fact, as stated for the Model 310 Wattmeter, Form 1, this instrument may also be used on sinusoidal wave shape for much higher frequencies, but the conservative frequency of 133 cycles per second is stated in order to eliminate possible errors due to the presence of harmonics of large amplitude.

CONSTANTS OF THE INSTRUMENT The resistance and inductance of the current and potential circuits for the various ranges are given on the certificate.

These values will be found of use in making corrections for the instrument losses when using the instrument on the "Uncompensated" position and as a means for determining the load on transformers when used in conjunction with the wattmeter, in order to allow for the transformer errors.

For methods of connection and uses of the instrument see pages 19 to 23.

Model 310 Wattmeter, Form 3

Form 3 Wattmeter is designed for use on circuits having frequencies greater than 133 cycles per second, such as are

found in the use of generators for wireless telegraphy, etc., in which the frequency is usually 500 cycles per second.

It is the same as Form 1 Wattmeter except that the temperature compensating feature is omitted. The error due to change in temperature, however, may be neglected for ordinary measurements. When precise measurements are desired, multiply the wattmeter indications by the correction factor which is stated on the certificate accompanying the instrument.

FREQUENCY ERRORS The instrument has a certified accuracy of 1/4 of 1% of full scale value for direct current or alternating current of any frequency up to 133 cycles per second at any power factor; and at unity power factor for any frequency up to the limit stated on the certificate.

For power factors less than unity on the higher frequencies the accuracy slightly diminishes as the power factor is reduced, but the errors arising are well within the limits of commercial requirements.

Use of the Model 310 Wattmeter, Form 1

The instrument should be connected to the circuit as shown in the diagrams found further back in this booklet, beginning with page 24, which cover all of the circuit conditions usually met with in practice.

In general, connect the field or current coil in series with the load and the potential circuit across or in parallel with the load as shown in Figure 6, page 24. Always connect the ± binding post of the potential circuit to the same side of the circuit under test in which the current coil of the wattmeter is connected. This should be done so as to have the current and potential coils at the same potential to eliminate the electrostatic attraction between them, which would otherwise introduce an error in the indications.

Turn the reversing switch to the position marked "Direct." If the indication of the instrument is reversed when the instrument is connected according to the instructions, change the reversing switch to the position marked "Reverse."

Figure 6, page 24, shows the simplest case of connections where the wattmeter is connected directly to the load. It will be noted that the field coils carry both the load current and the current required by the potential circuit, so that the indication of the wattmeter includes the power lost in its own potential circuit. The instrument is not compensated for this loss, but as the average value for the regular wattmeter is only about 2 watts at a potential of 110 volts, a correction need not be made for it when a loss of 2 watts is negligible in comparison to the watts of the load under test. In testing other wattmeters, if the diagrams are followed, the wattmeter loss does not enter in and of course does not need to be considered.

When current and potential transformers are used, the correction for the wattmeter loss usually becomes so small as to be negligible.

In making measurements where the wattmeter loss cannot be neglected, the indications can be corrected as shown on pages 21 and 22.

UTILIZATION OF OVERLOAD CAPACITY The advantage of an instrument with an overload capacity is best demonstrated by means of an example. Suppose we have a wattmeter, normal current capacities of 5 and 10 amperes, normal potential capacities of 75 and 150 volts. The maximum capacities of this instrument are 10 and 20 amperes, 125 and 250 volts respectively.

We wish to use the instrument to ascertain the power in a circuit the current being 7.5 amperes, voltage 110 volts and power factor 80 per cent. The watts indicated on the in-

strument will be $7.5 \times 110 \times 0.8 = 660$ watts. Ordinarily the 10-ampere and 150-volt ranges would be used, the watt range being 1500 watts for full scale deflection.

The indication produced by 660 watts would be a little less than half scale. Since the 5-ampere range can carry 10 amperes, this range can be used with the 7.5 ampere current, thus getting a pointer deflection twice that obtained before, the full scale value now being 750 watts. In this way it is possible to obtain more accurate readings than at a lower portion of the scale.

If the 10-ampere range and the 75-volt range are used instead of the 5-ampere and 150-volt ranges the same result will be obtained. This illustrates one advantage of the overload capacity of the potential circuit. Another advantage is the ability to use a range adjusted for use on one commercial voltage on the next higher voltage, for instance a 150-volt instrument which would nominally be used on 110-volt circuits can be used on 220-volt circuits also.

Numerous instances will occur in practice where the overload feature will be found of great value.

USE OF MULTIPLIER When a multiplier is used, it must be connected to the range of the instrument to which it is adjusted. For example suppose we have an instrument with potential ranges of 75 and 150 volts, and a multiplier for 300 volts. The multiplier will have a binding post marked $\frac{150\,V}{1}$ and one marked $\frac{300\,V}{2}$.

Connect the binding post of the multiplier which is marked $\frac{150\,V}{1}$ to the binding post of the instrument which is marked 150; then connect the $\frac{300V}{2}$ binding post of the multiplier to that wire of the circuit which does not contain the current circuit of the wattmeter (see Figure 7, page 24).

The marking $\frac{300V}{2}$ means that the watts as indicated by the instrument must be multiplied by 2 to obtain the total watts when using the 300 volt range of the instrument.

Care must be taken never to connect the multiplier to the ± binding post of the instrument as such a connection will put the full line voltage between the current and potential coils, which may cause electrostatic attraction between them introducing errors and it places an unnecessary stress upon the insulation.

ALTERNATIVE METHOD OF CONNECTIONS The wattmeter may be connected to the circuit as shown in Figure 5, page 18. In this method the potential circuit of the wattmeter is connected on the source side of the current coil and the instrument includes in its indication the power lost in the circuit between the potential circuit connection and the load; that is the loss

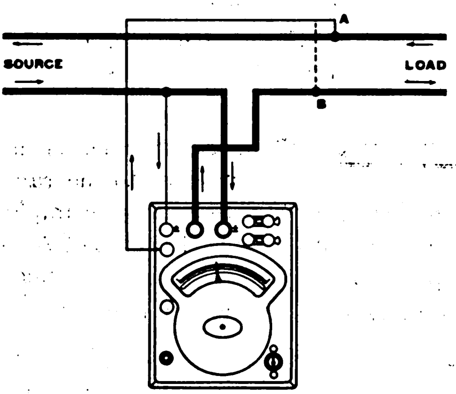

Figure 5

Connections for Measuring D. C. and Single Phase A. C. Power: Instrument Connected to Include in the Indication Its Current Circuit Losses.

in switches, fuses, or other auxiliary apparatus as well as in the current or field coils of the instrument.

This method of connection possesses several disadvantages; when current transformers are used it is difficult and often impracticable to allow for the losses, and in all cases the losses vary with the current and with changes in temperature so that the correction to be applied very often cannot be accurately determined.

In cases where the only loss between the wattmeter connection and the load is that of the wattmeter current circuit, the loss is usually so small that it can be neglected.

Should any circumstances arise necessitating the use of this method of connection, the wattmeter indication may be corrected as shown on page 23, or the loss may be experimentally determined by changing the potential connection from A to B in Figure 5, page 18.

Use of the "Low Power Factor" Model 310 Wattmeter, Form 2

The general directions given under "Use of the Model 310 Wattmeter, Form 1, page 15, and diagrams of connection, pages 24 to 43, apply to this instrument.

Turn the reversing switch to the position marked "Direct." If the indication of the instrument is reversed when connections have been made according to instructions, change the reversing switch to the position marked "Reverse."

When the instrument is connected directly to the load it may be used either compensated or uncompensated. When current or potential transformers are used the instrument *must be used uncompensated*.

When using the instrument compensated the compensating

switch is set to that position corresponding to the current range being used.

When using the instrument uncompensated the compensating switch is set to the uncompensated position. The instrument is then similar to the Model 310 Wattmeter, Form 1. If it is necessary to apply corrections for the instrument losses the same methods are employed as for the Model 310 Wattmeter, Form 1. (See page 21.)

The "Alternative Method of Connections" should only be used with the instrument uncompensated.

Particular Applications of the Instrument

Because of the high volt-ampere capacity of the instrument it is particularly well adapted for making measurements on circuits in which the current and voltage are high and the power factor low, such as is the case when making core loss measurements on transformers. As an illustration suppose the wattmeter has a maximum current capacity of 5 amperes and maximum voltage capacity of 150 volts. The maximum volt-ampere capacity will be 750 volt-amperes. A full scale deflection, however, will be obtained with 150 watts.

The instrument can also be used in measuring the watt losses in parts of an ordinary circuit wherein the current is comparatively high and the voltage across the part to be tested comparatively low.

It can also be used in making power measurements on circuits of comparatively high current but of low voltage source.

Use of the Model 310 Wattmeter, Form 3

The Form 3 Wattmeter is used in the same manner as the Form 1 Wattmeter and the instructions on pages 15 to 19 hould be referred to.

Methods of Correcting for Wattmeter Losses When the Wattmeter is Connected in Circuit as Shown in Figures 6 to 15, Pages 24 to 29

It has been stated on page 16 that the instrument indicates the sum of the load watts and the watts loss in the wattmeter. In order to determine the actual power of the load in watts ascertain the total watts as indicated by the instrument, and from this value subtract the instrument losses.

The correction to be applied for the various cases in which the instrument may be used is numerically illustrated in the following examples.

CASE 1. WATTMETER CONNECTED DIRECTLY TO THE LOAD

See Figure 6, page 24. Assume the readings of the wattmeter to be 560 watts, the line voltage 114 volts and the resistance of the potential range 6500 ohms.

The loss in the potential circuit is $\frac{(114)^2}{6500}$ or 2 watts; this subtracted from the indicated 560 watts gives 558 watts as the actual power of the load.

If a multiplier is used the wattmeter indication is multiplied by the constant of the multiplier and the loss in both multiplier and instrument subtracted from that value. (Figure 7, page 24.)

CASE 2. WATTMETER CONNECTED TO THE LOAD THROUGH A CURRENT TRANSFORMER

See Figure 8, page 25. Assume the reading of the wattmeter to be 560 watts, the line voltage 114 volts, the resistance of the potential range 6500 ohms and the ratio factor of the current transformer to be 5. The total power ascertained from the wattmeter indication is 5 x 560 or 2800 watts.

The loss in the potential circuit is $\frac{(114)^2}{6500}$ or 2 watts; this loss subtracted from the total of 2800 watts gives 2798 watts as the actual power of the load.

CASE 3. WATTMETER CONNECTED TO THE LOAD THROUGH A POTENTIAL TRANSFORMER* See Figure 10, page 26. Assume the reading of the wattmeter to be 560 watts, the line voltage 5700 volts, the resistance of the potential range 6500 ohms, and the ratio factor of the potential transformer to be 50. The total power ascertained from the wattmeter indication is 50 x 560 or 28000 watts.

The voltage applied directly to the wattmeter potential circuit is $\frac{5700}{50}$ or 114 volts. The loss in the wattmeter is $\frac{(114)^2}{6500}$ or 2 watts; this loss subtracted from the total of 28000 watts gives 27998 † watts as the actual power of the load.

CASE 4. WATTMETER CONNECTED TO THE LOAD THROUGH POTENTIAL TRANSFORMER AND A CURRENT TRANSFORMER*

See Figure 11, page 26. Assume the reading of the wattmeter to be 560 watts, the line voltage 5700 volts, the resistance of the potential range 6500 ohms, the ratio factor of the current transformer 5 and the ratio factor of the potential transformer to be 50. The total power ascertained from the wattmeter indication is 560 x 5 x 50 or 140000 watts.

The voltage applied directly to the potential circuit of the wattmeter is $\frac{5700}{50}$ or 114 volts. The loss in the wattmeter is $\frac{(114)^2}{6500}$ or 2 watts; this loss subtracted from the total of 140000 watts gives 139998 † watts as the actual power of the load.

*The Corrections as given do not include transformer losses.

† These figures are of course beyond the reading limits of the instrument and are used merely to illustrate the method of making corrections and to show that the effect of the wattmeter losses is entirely negligible in this case.

Methods of Correcting for Wattmeter Losses When the Wattmeter is Connected in Circuit According to the "Alternative Method of Connection" Shown in Figure 5, Page 18.

CASE 1. WATTMETER CONNECTED DIRECTLY TO THE LOAD

Assume the reading of the wattmeter to be 560 watts. The current through the field coils 5 amperes and the resistance of the field coil circuit 0.03 ohms.

The loss in the field coil circuit is $(5)^2 \times 0.03$ or 0.75 watt; this loss subtracted from the indicated watts gives 560—0.75 or 559.25 watts as the actual power of the load.

If a multiplier is used the wattmeter indication is multiplied by the constant of the multiplier and the loss in the field coil circuit subtracted from this value.

CASE 2. WATTMETER CONNECTED TO THE LOAD THROUGH A POTENTIAL TRANSFORMER* Assume the reading of the wattmeter to be 560 watts, the current through the field coils 5 amperes, the resistance of the field coil circuit 0.03 ohm, and the ratio factor of the potential transformer to be 50.

The total power ascertained from the wattmeter indication is 560×50 or 28000 watts.

The loss in the field coil circuit is $(5)^2 \times 0.03$ or 0.75 watt; this loss subtracted from the total of 28000 watts gives 27999.25 † watts as the actual power of the load.

Note: These corrections only take into account the loss in the wattmeter field circuit and do not include any switches, fuses or other auxiliary apparatus.

* See corresponding foot-note on page 22.

† See corresponding foot-note on page 22.

Diagrams of Connections for Using Weston Model 310 Wattmeter

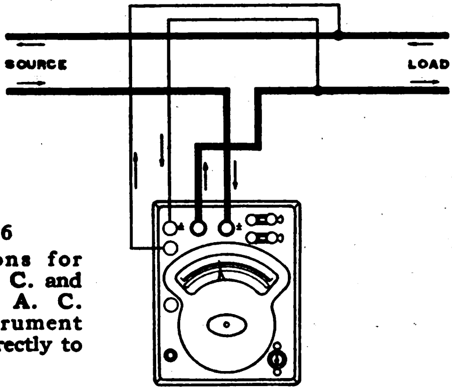

Figure 6
Connections for Measuring D. C. and Single Phase A. C. Power; Instrument Connected Directly to Load.

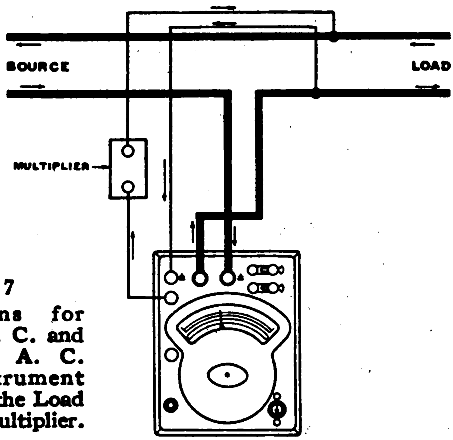

Figure 7
Connections for Measuring D. C. and Single Phase A. C. Power; Instrument Connected to the Load Through a Multiplier.

Diagrams of Connections—Continued

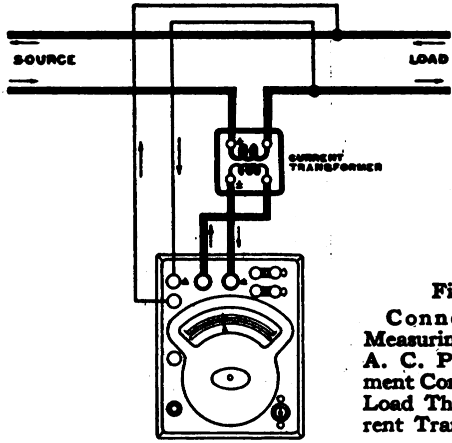

Figure 8

Connections for Measuring Single Phase A. C. Power; Instrument Connected to the Load Through a Current Transformer.

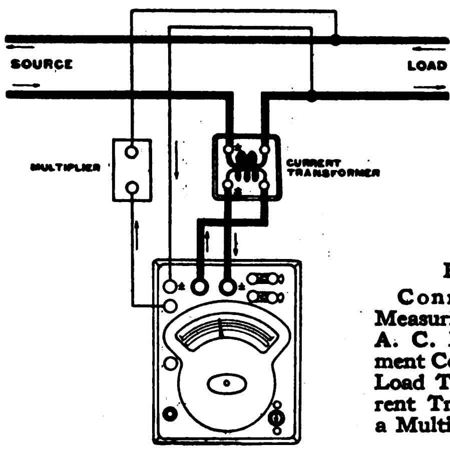

Figure 9

Connections for Measuring Single Phase A. C. Power; Instrument Connected to the Load Through a Current Transformer and a Multiplier.

Diagrams of Connections—Continued

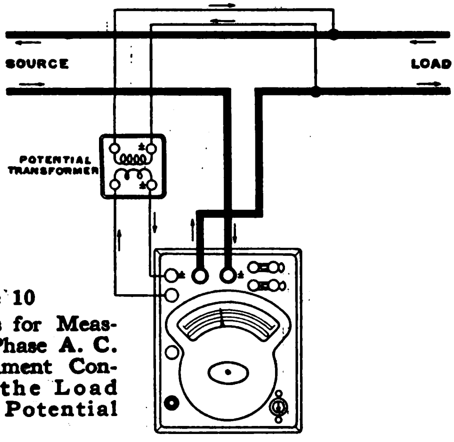

Figure 10

Connections for Measuring Single Phase A. C. Power; Instrument Connected to the Load Through a Potential Transformer.

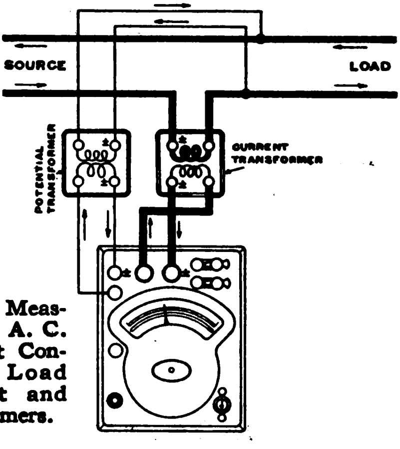

Figure 11

Connections for Measuring Single Phase A. C. Power; Instrument Connected to the Load Through Current and Potential Transformers.

Diagrams of Connections—Continued

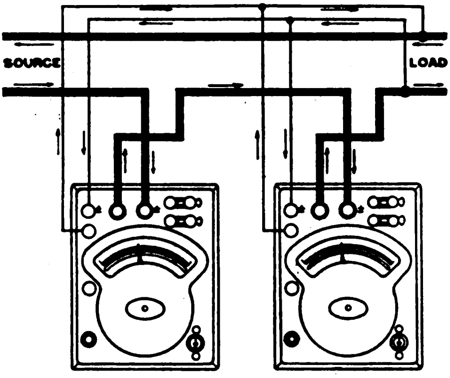

Figure 12

Connections for Comparing Two Wattmeters, Using D. C. or A. C. Source; Instruments Connected Directly to the Load.

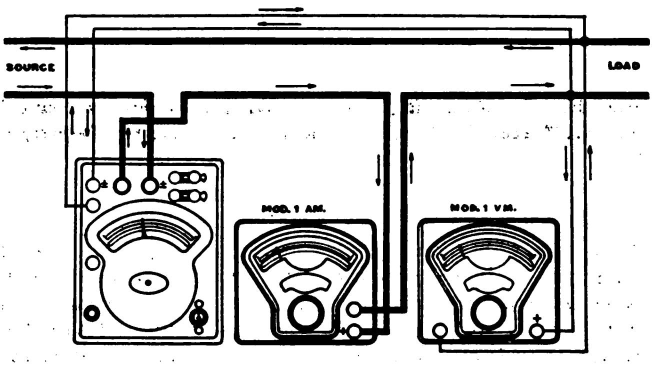

Figure 13

Connections for Checking a Wattmeter with Ammeter and Voltmeter Using a D. C. Source.

Diagrams of Connections—Continued

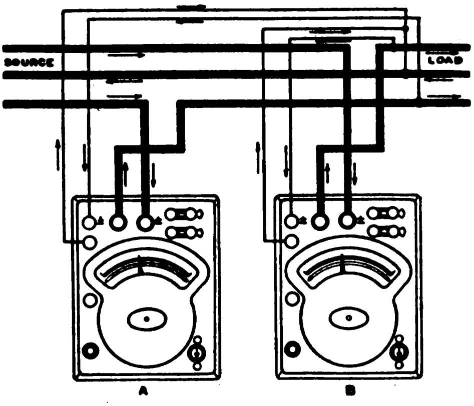

Figure 14

Connections for Measuring Power in D. C., Single, Two and Three Phase A. C. Three-Wire Circuits; Instruments Connected Directly to the Load.

Note: For Three Phase Circuits, if both instruments deflect toward the top of the scale, when connected as shown, the true power is the sum of their indications. If one instrument deflects negatively, which will be the case when the power factor is below 50%, change the Reversing Switch and subtract the indication from that of the other instrument to obtain the true power. If only one Wattmeter is available connect it successively as A and B in cut and proceed as directed above. Arrows indicate directions of current for Two and Three Phase Circuits but not for D. C. or Single Phase Circuits.

Diagrams of Connections—Concluded

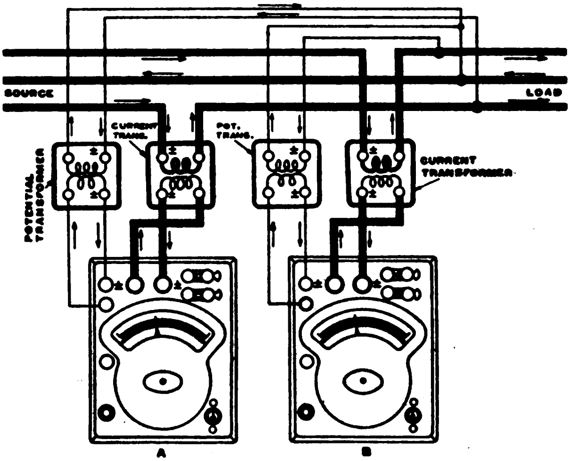

Figure 15

Connections for Measuring Power in Single, Two and Three Phase, Three-Wire A. C. Circuits; Instruments Connected to the Load Through Current and Potential Transformers.

Note: For Three Phase Circuits, if both instruments deflect toward the top of the scale, when connected as shown, the true power is the sum of their indications. If one instrument deflects negatively, which will be the case when the power factor is below 50%, change the reversing Switch and subtract the indication from that of the other instrument to obtain the true power. If only one Wattmeter is available connect it successively as A and B in cut and proceed as directed above. Arrows indicate directions of current for Two and Three Phase Circuits but not for Single Phase Circuits.

Diagrams for Connections for Checking Watthour Meters by Means of Weston Model 310 Wattmeter

Two-Wire Watthour Meter with Only One Side of the Circuit Passing Through the Watthour Meter

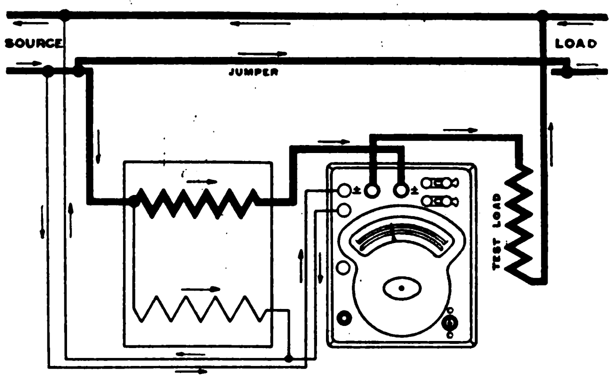

Figure 16.

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and Test Load.

Two-Wire Watthour Meter with Only One Side of the Circuit Passing Through the Watthour Meter—Concluded

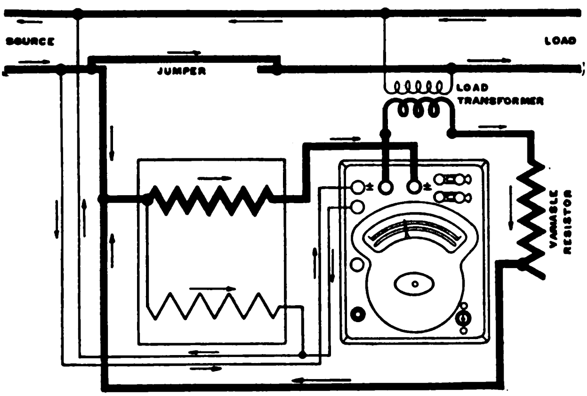

Figure 17

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and a Load Transformer.

Two-Wire Watthour Meter with Both Sides of the Circuit Passing Through the Watthour Meter

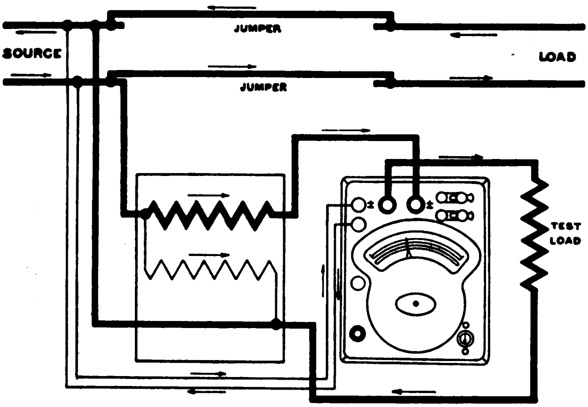

Figure 18

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and Test Load.

Two-Wire Watthour Meter with Both Sides of the Circuit Passing Through the Watthour Meter—Concluded

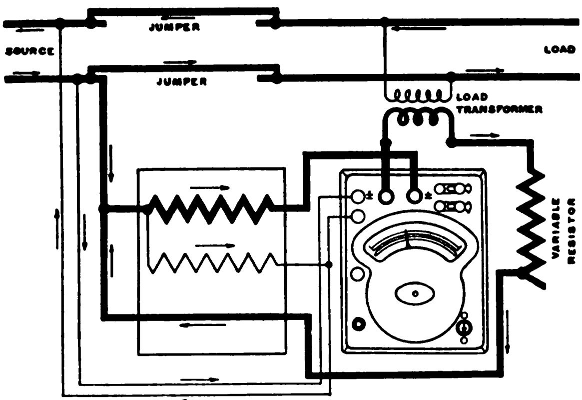

Figure 19

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and a Step-down Load Transformer.

Three-Wire Watthour Meter

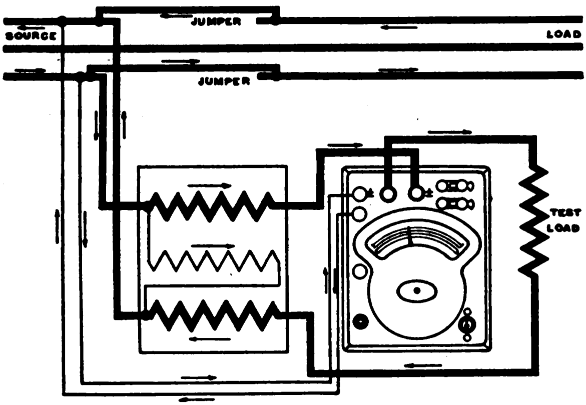

Figure 20

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and Test Load.

(Potential circuit connected to outer wires.)

Three-Wire Watthour Meter—Concluded

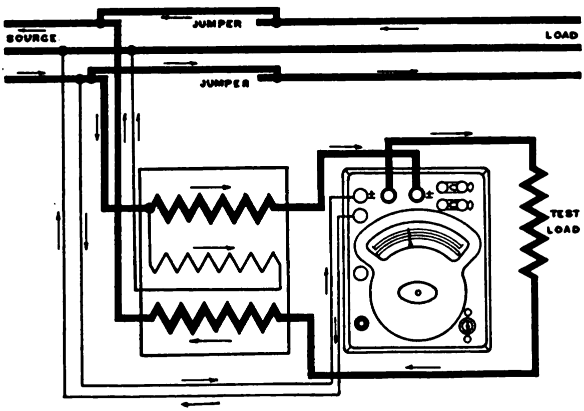

Figure 21

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and Test Load.

(Potential circuit between neutral and one outer wire. Test constant of the watthour meter is halved.)

Polyphase Watthour Meter

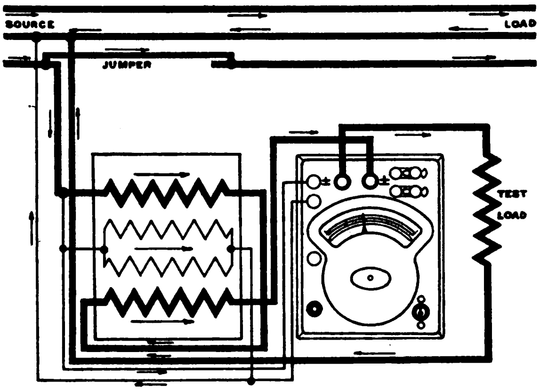

Figure 22

Connections for Testing a Polyphase Watthour Meter as a Single Phase Instrument by Means of a Weston Model 310 Wattmeter and Test Load.

(Watthour meter current coils in series and potential circuits in parallel.)

Polyphase Watthour Meter—Concluded

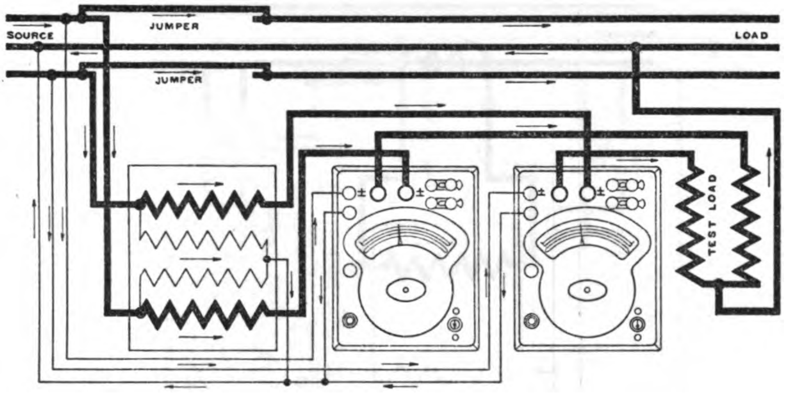

Figure 23

Connections for Testing a Polyphase Watthour Meter by Means of Two Weston Model 310 Wattmeters and an "Open Delta" Connected Test Load Using a Three Phase or a Two Phase Three Wire Source.

Watthour Meter with Current Transformer

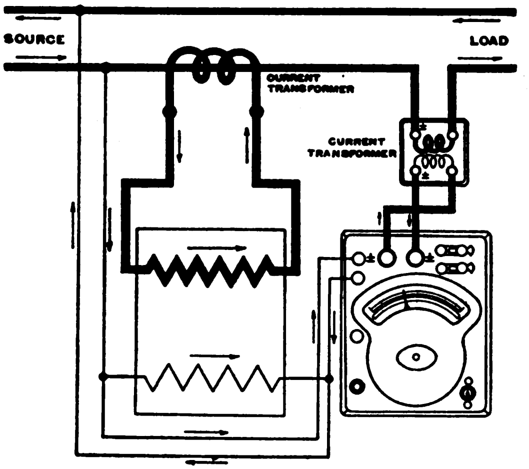

Figure 24

Connections for Testing a Watthour Meter Used with a Current Transformer, by Means of a Weston Model 310 Wattmeter with Current Transformer, Using Consumer's Load.

Watthour Meter with Current Transformer
Continued

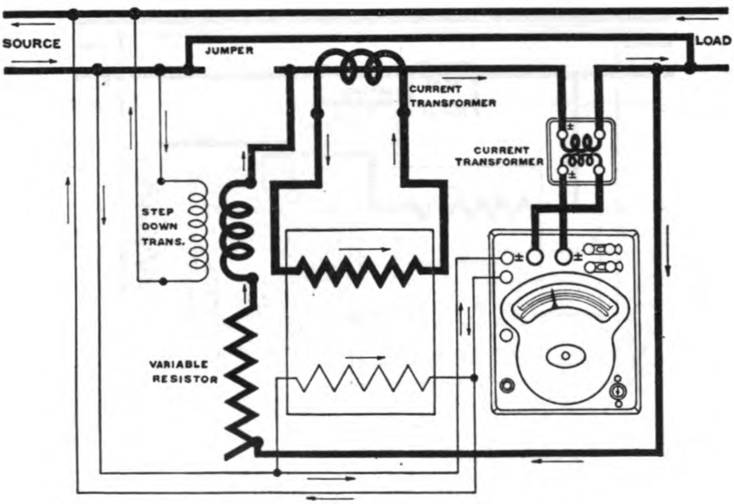

Figure 25

Connections for Testing a Watthour Meter by Means of a Weston Model 310 Wattmeter and Current Transformer and a Step-Down Transformer Connected to the Service Lines.

Watthour Meter with Current Transformer
Concluded

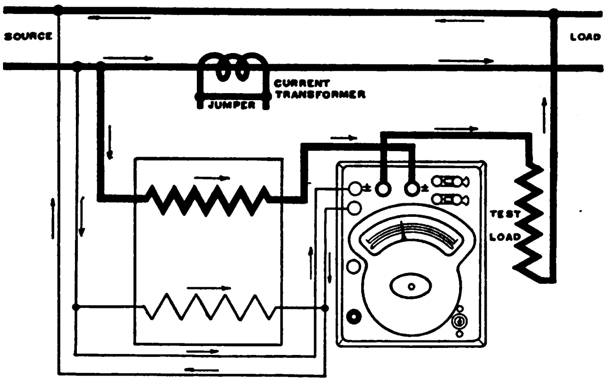

Figure 26

Connections for Making Secondary Test on a Watthour Meter by Means of a Weston Model 310 Wattmeter and Test Load.

Note: The Jumper must be put in place before opening the Watthour Meter Current Circuit.

Watthour Meter with Current and Potential Transformers

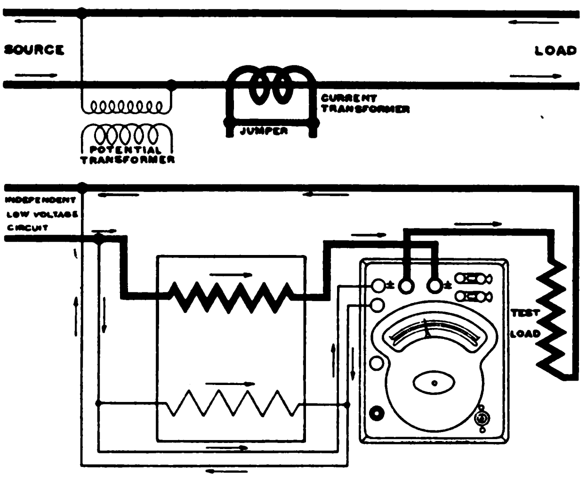

Figure 27

Connections for Testing a Watthour Meter from an Independent Low Voltage Source by Means of a Weston Model 310 Wattmeter and Test Load.

Note: The Jumper must be put in place before opening the Watthour Meter Current Circuit.

Watthour Meter with Current and Potential Transformers—Continued

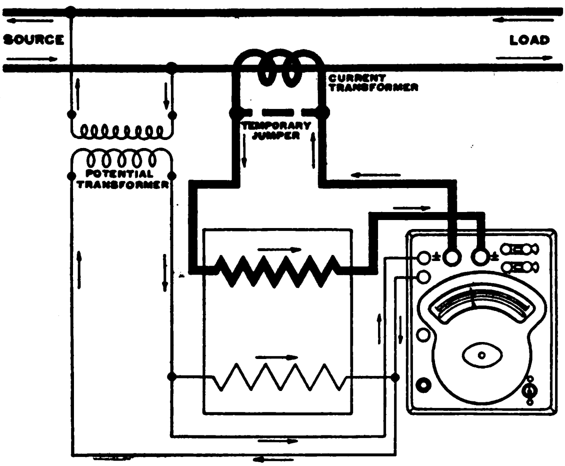

Figure 28

Connections for Testing a Watthour Meter When Equipped with Current and Potential Transformers by Means of a Weston Model 310 Wattmeter.

Note: The Temporary Jumper must be put in place before opening the Watthour Meter Circuit to insert the Wattmeter, and may only be removed after the circuit is again completed.

Watthour Meter with Current and Potential Transformers—Concluded

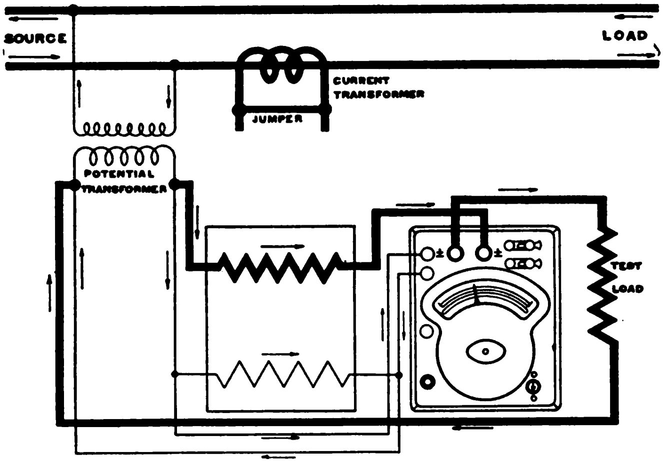

Figure 29

Connections for Testing a Watthour Meter on a Low Load from the Secondary of the Potential Transformer by Means of a Weston Model 310 Wattmeter and Test Load.

Note: The Jumper must be put in place before opening the Watthour Meter Current Circuit.

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